US009630799B2

(12) **United States Patent**
Galea

(10) **Patent No.: US 9,630,799 B2**
(45) **Date of Patent: Apr. 25, 2017**

(54) **METHOD AND APPARATUS FOR FABRICATING STRETCH FILM ROLLS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 246 days.

(21) Appl. No.: **14/332,446**

(22) Filed: **Jul. 16, 2014**

(65) **Prior Publication Data**

US 2016/0016747 A1 Jan. 21, 2016

(51) **Int. Cl.**
B65H 20/28 (2006.01)
B65H 45/22 (2006.01)

(52) **U.S. Cl.**
CPC ***B65H 45/22*** (2013.01); *B65H 2301/3612* (2013.01); *B65H 2301/5124* (2013.01); *B65H 2301/51214* (2013.01); *B65H 2404/51* (2013.01); *B65H 2404/61* (2013.01); *B65H 2404/662* (2013.01); *B65H 2404/6942* (2013.01); *B65H 2701/1944* (2013.01)

(58) **Field of Classification Search**
CPC B65H 20/28; B65H 18/10; B65H 37/06; B65H 2701/31; B65D 65/00
USPC 264/285, 280
See application file for complete search history.

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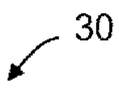
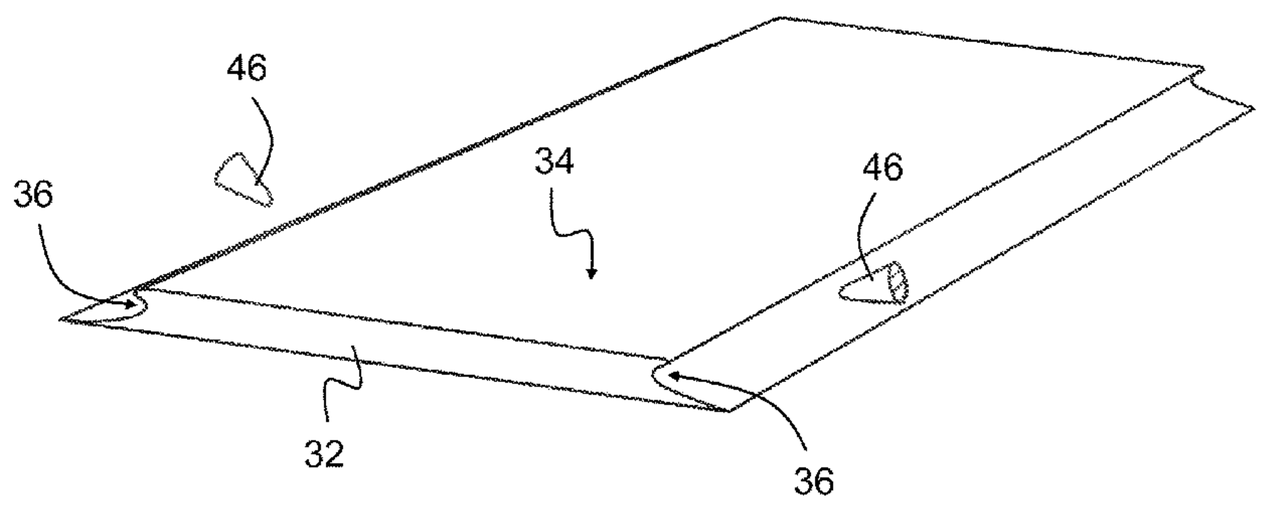
(57) **ABSTRACT**

An apparatus for fabricating a stretch film roll comprises a device configured to fold a stretch film web to yield a folded stretch film web comprising at least one longitudinal band of increased thickness, with each band of increased thickness being spaced from the longitudinal edges of the folded stretch film web, and a driven winding shaft for winding the folded stretch film web.

15 Claims, 14 Drawing Sheets





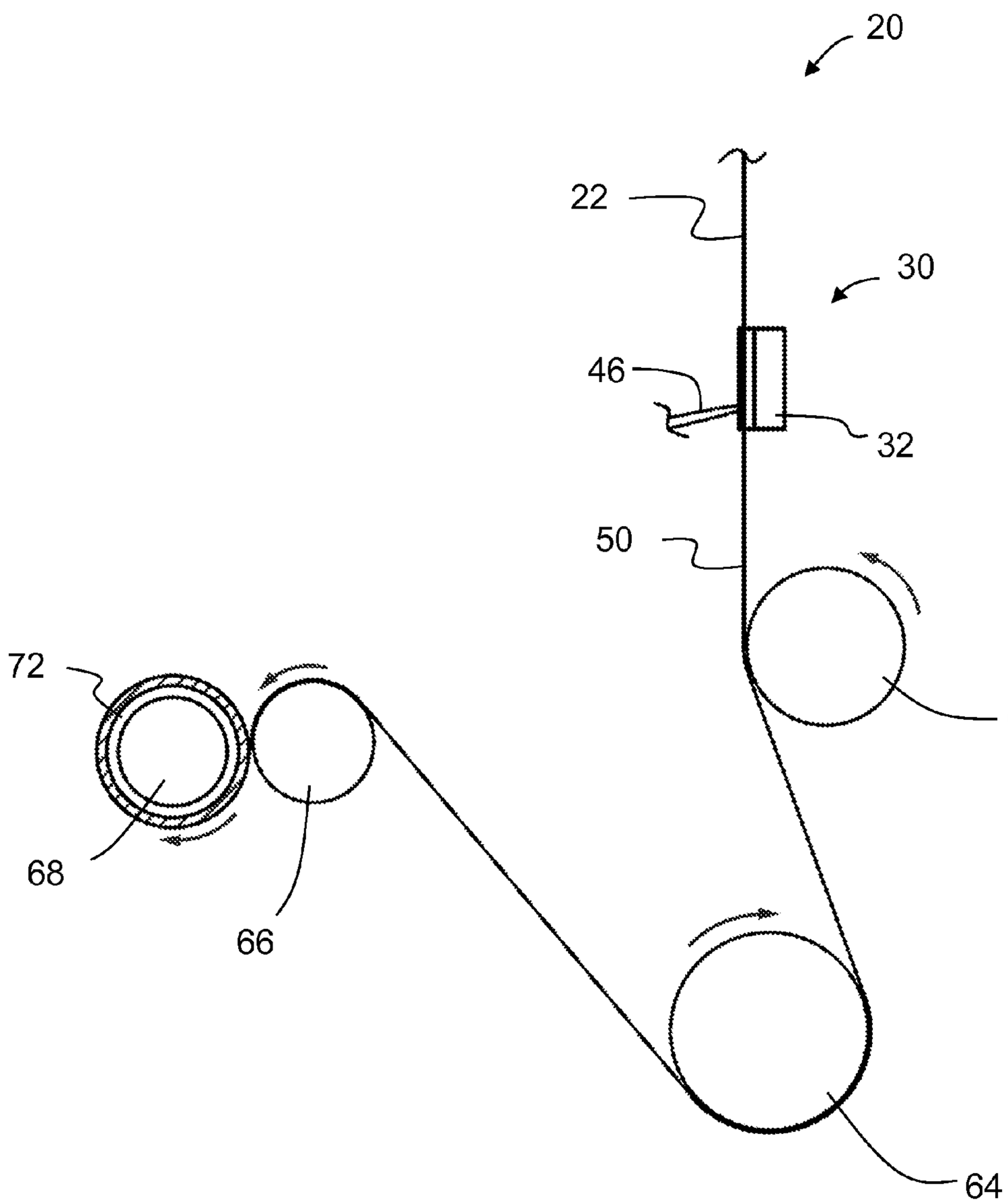


Figure 1

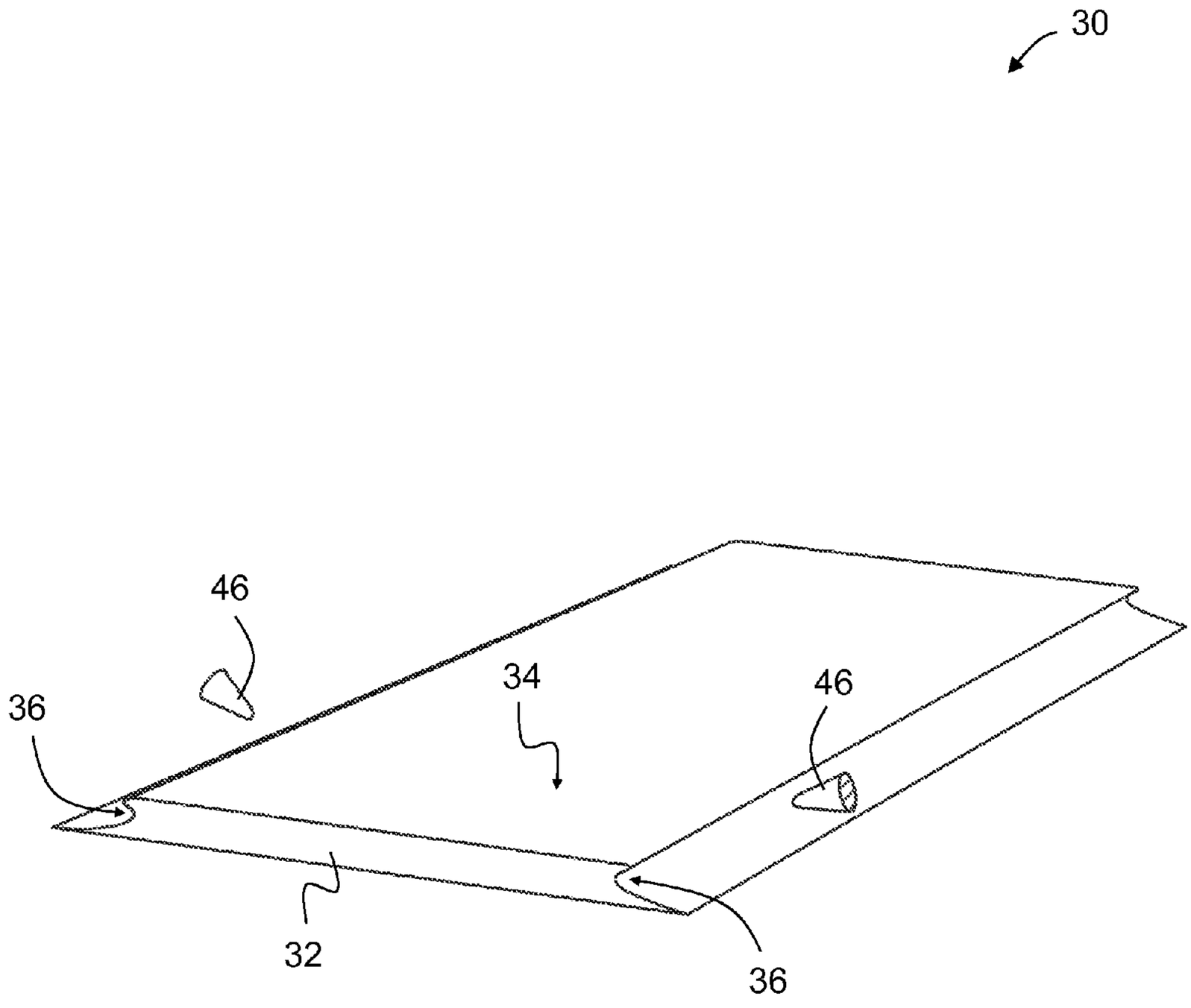


Figure 2

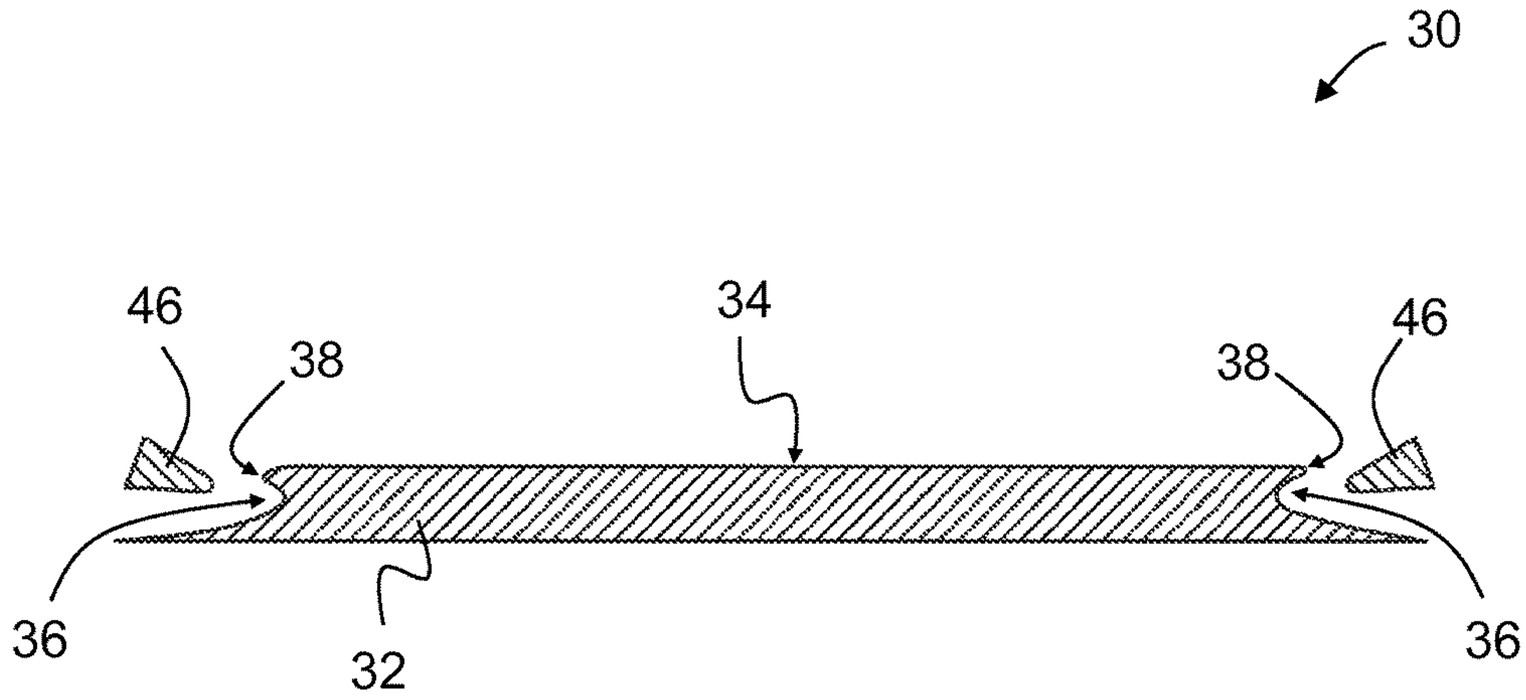


Figure 3

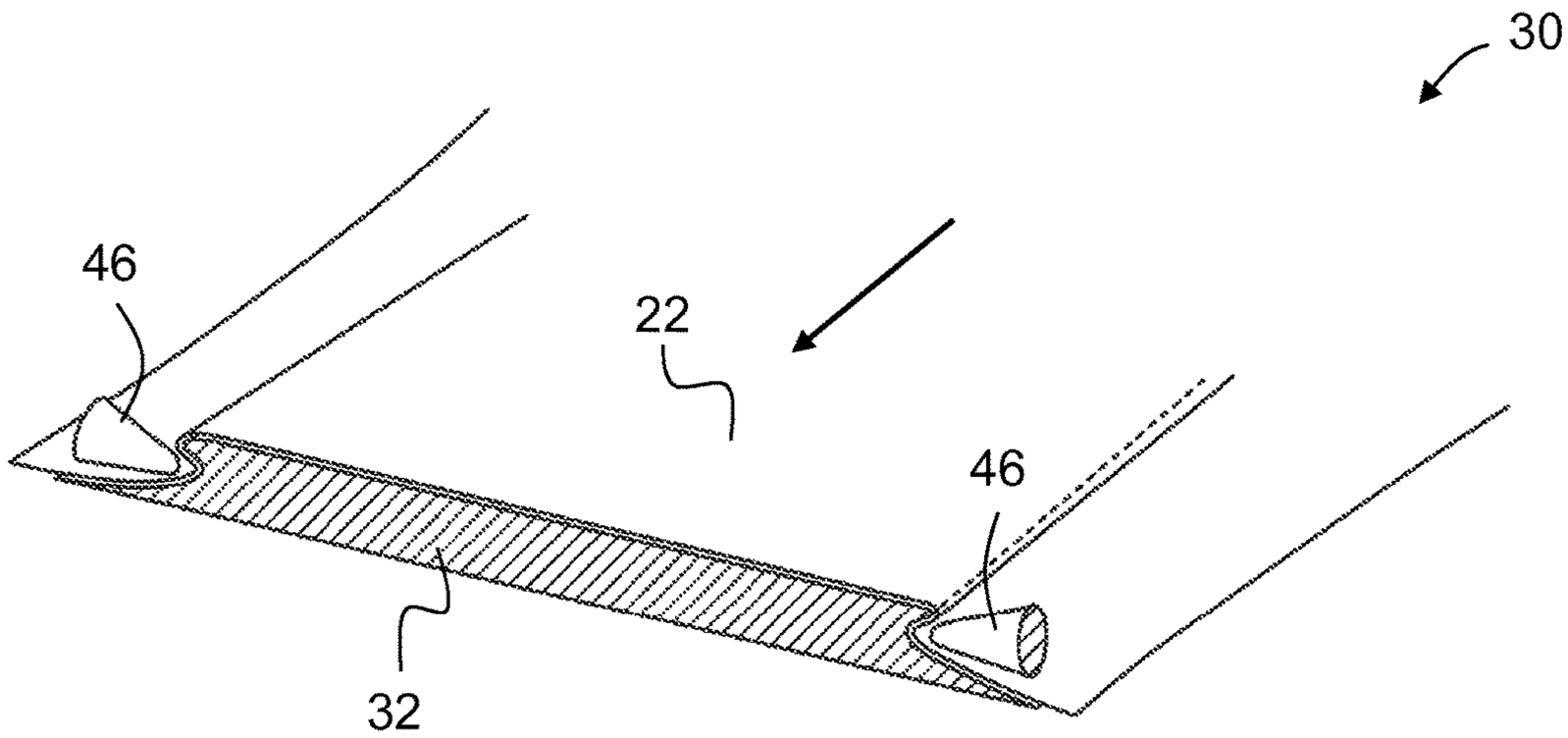


Figure 4

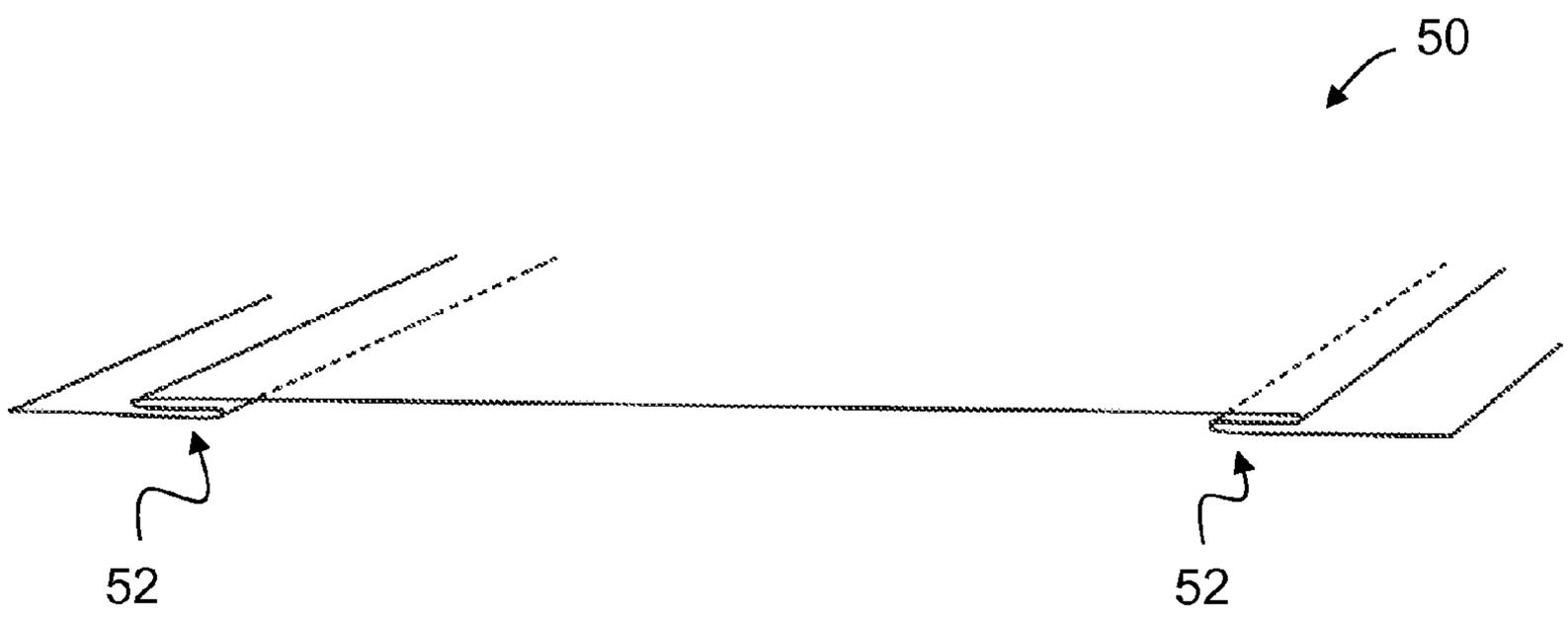


Figure 5

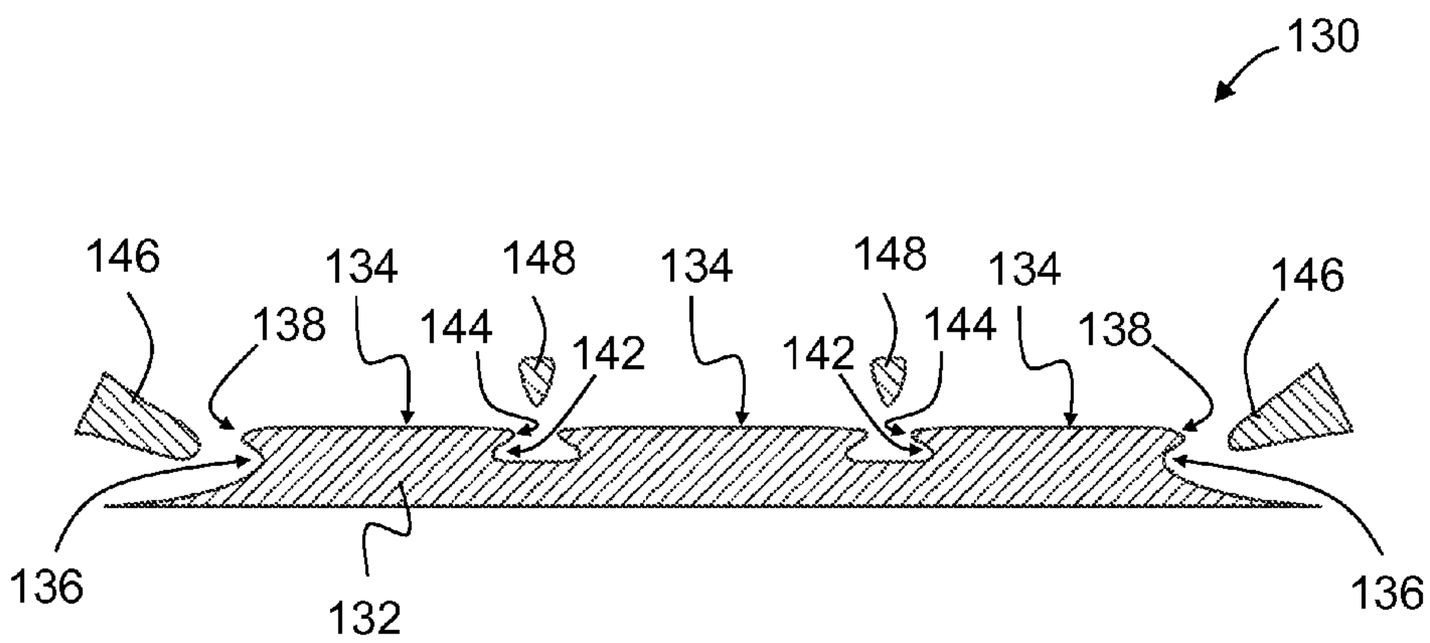


Figure 6

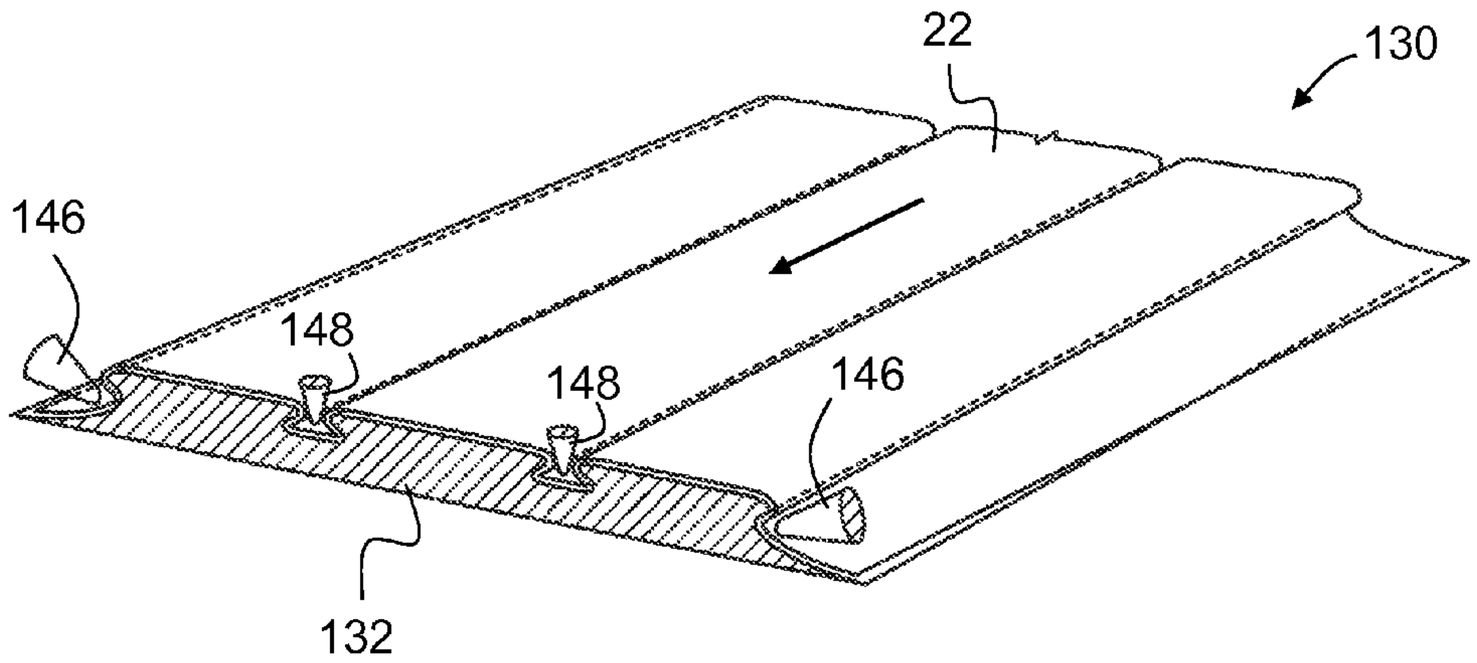


Figure 7

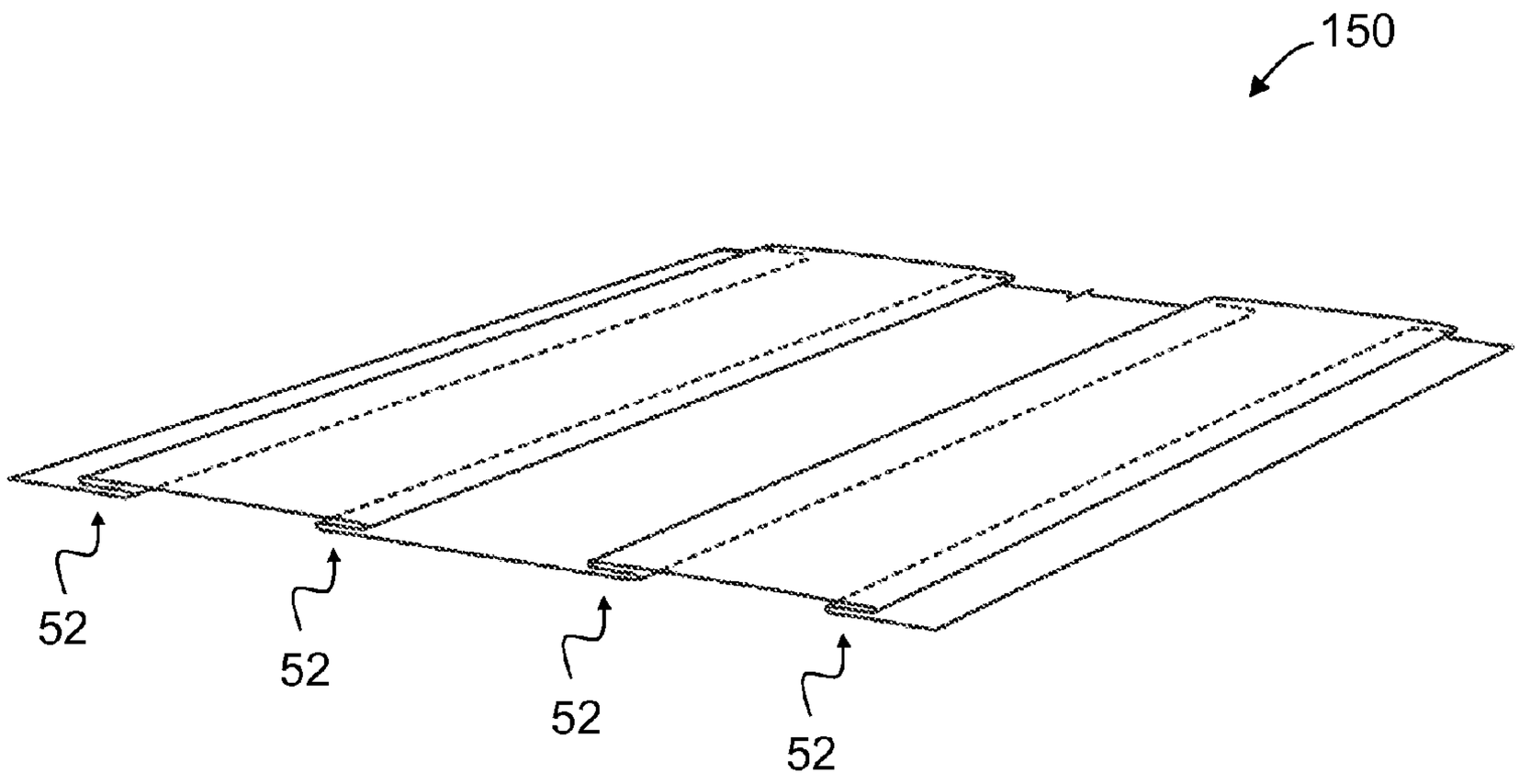


Figure 8

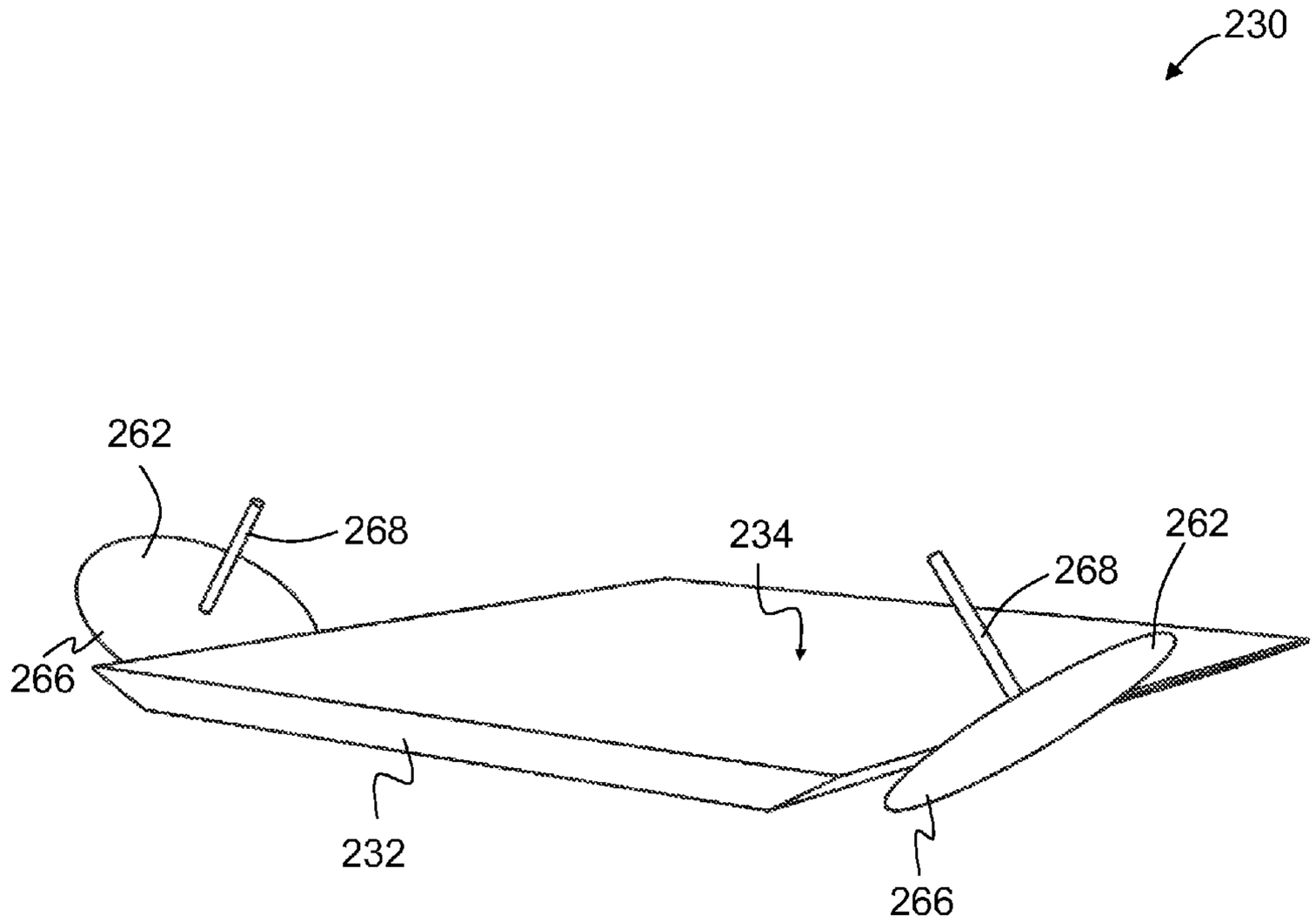


Figure 9

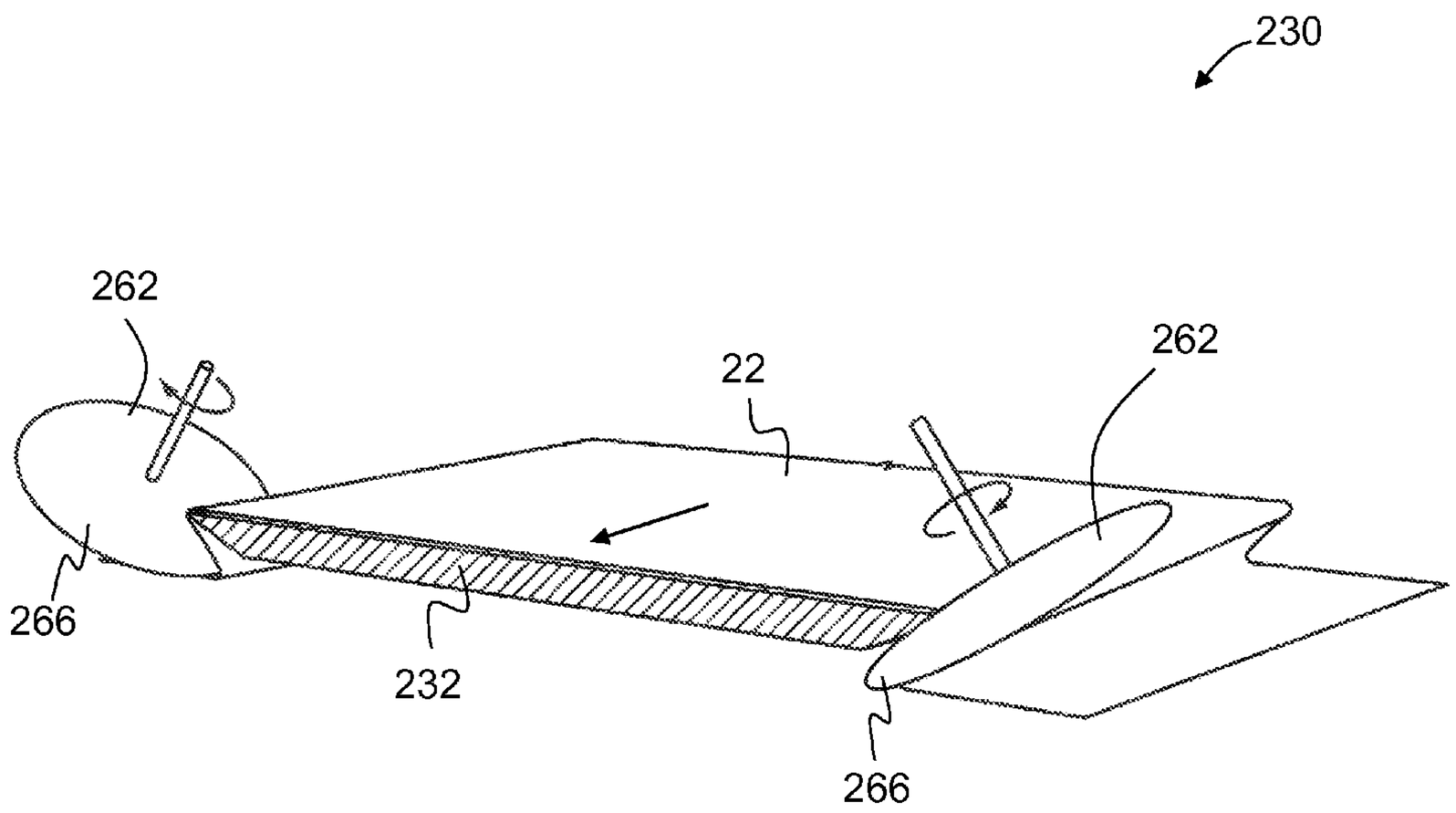


Figure 10

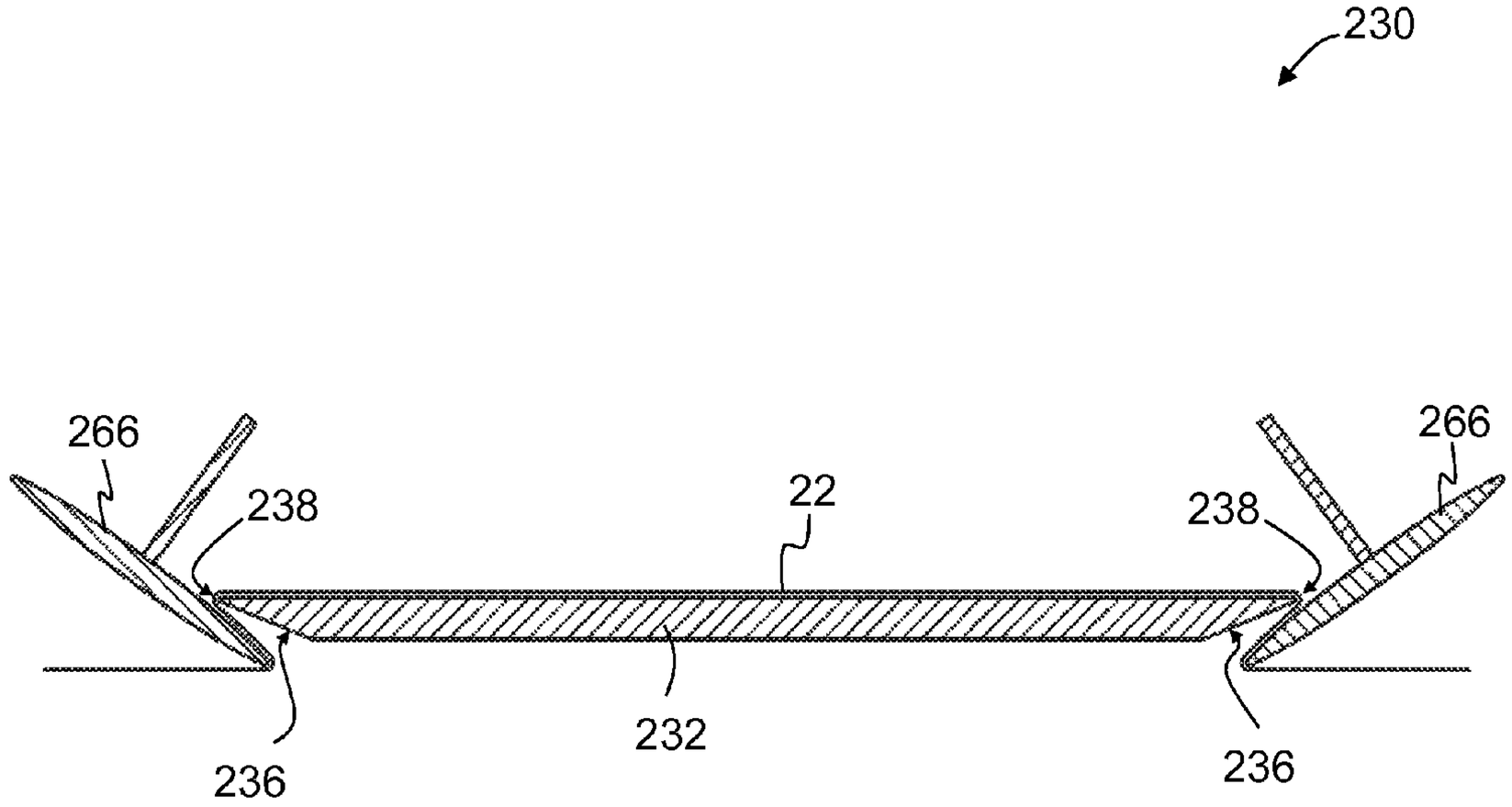


Figure 11

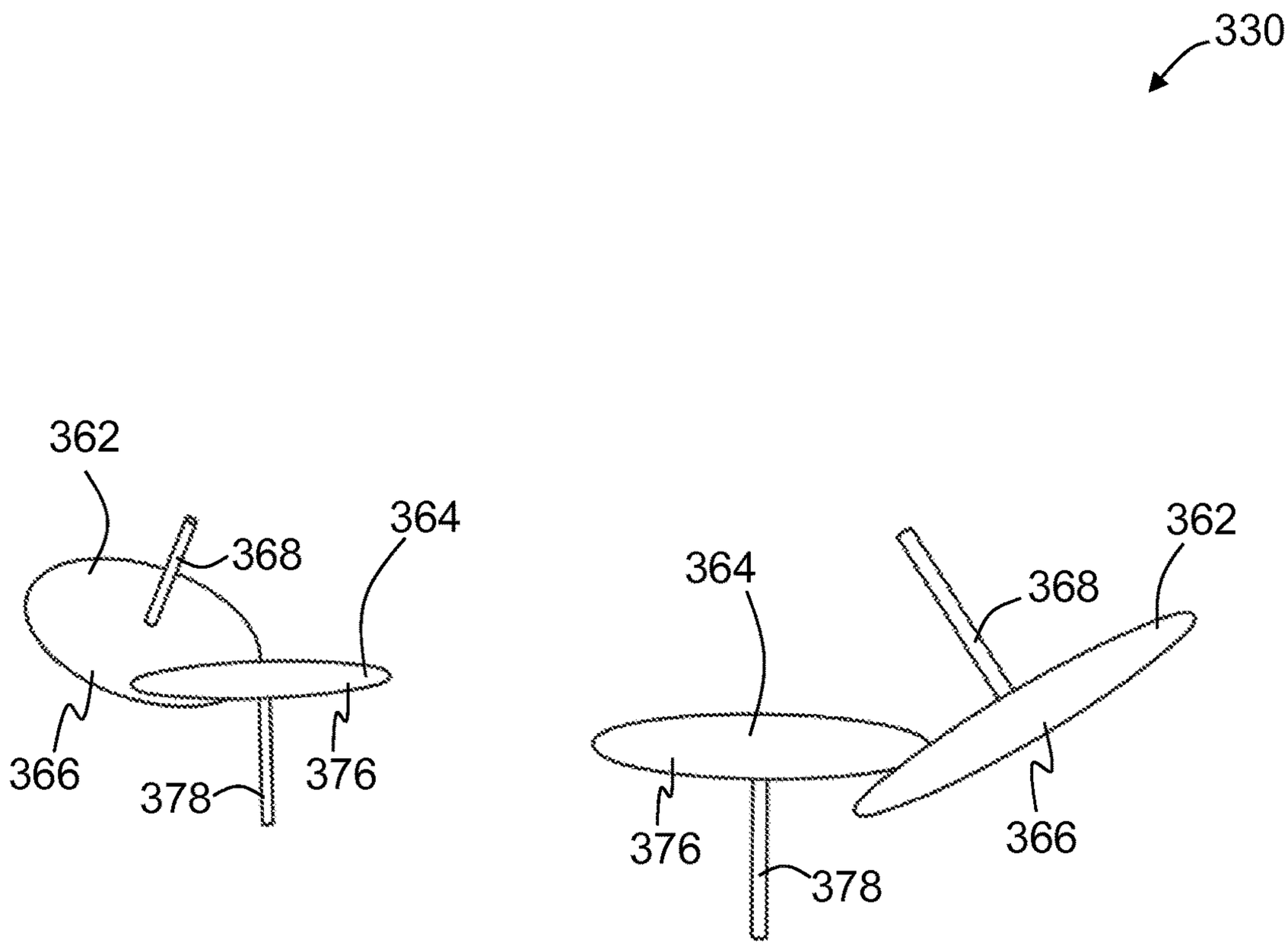


Figure 12

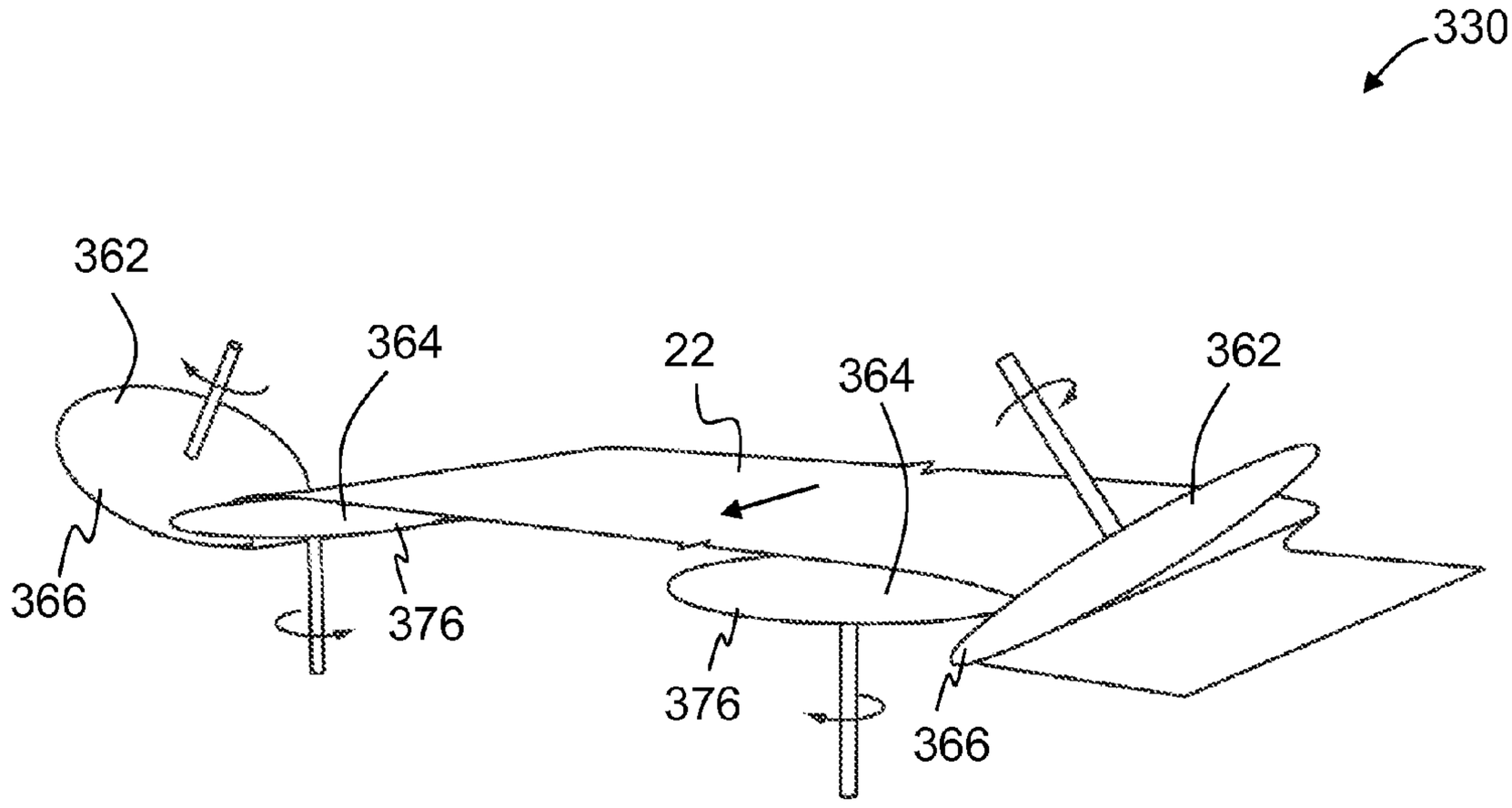


Figure 13

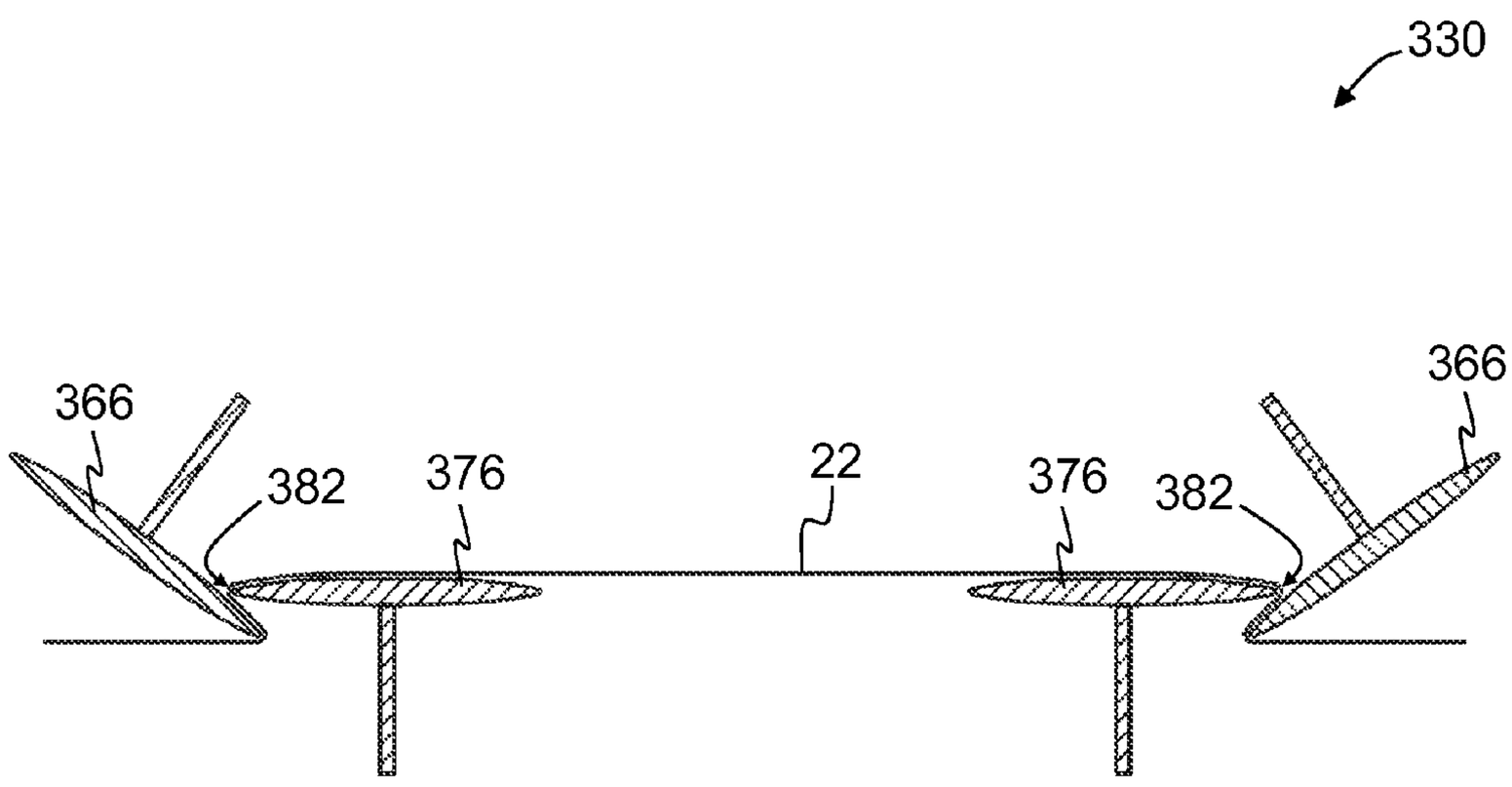


Figure 14

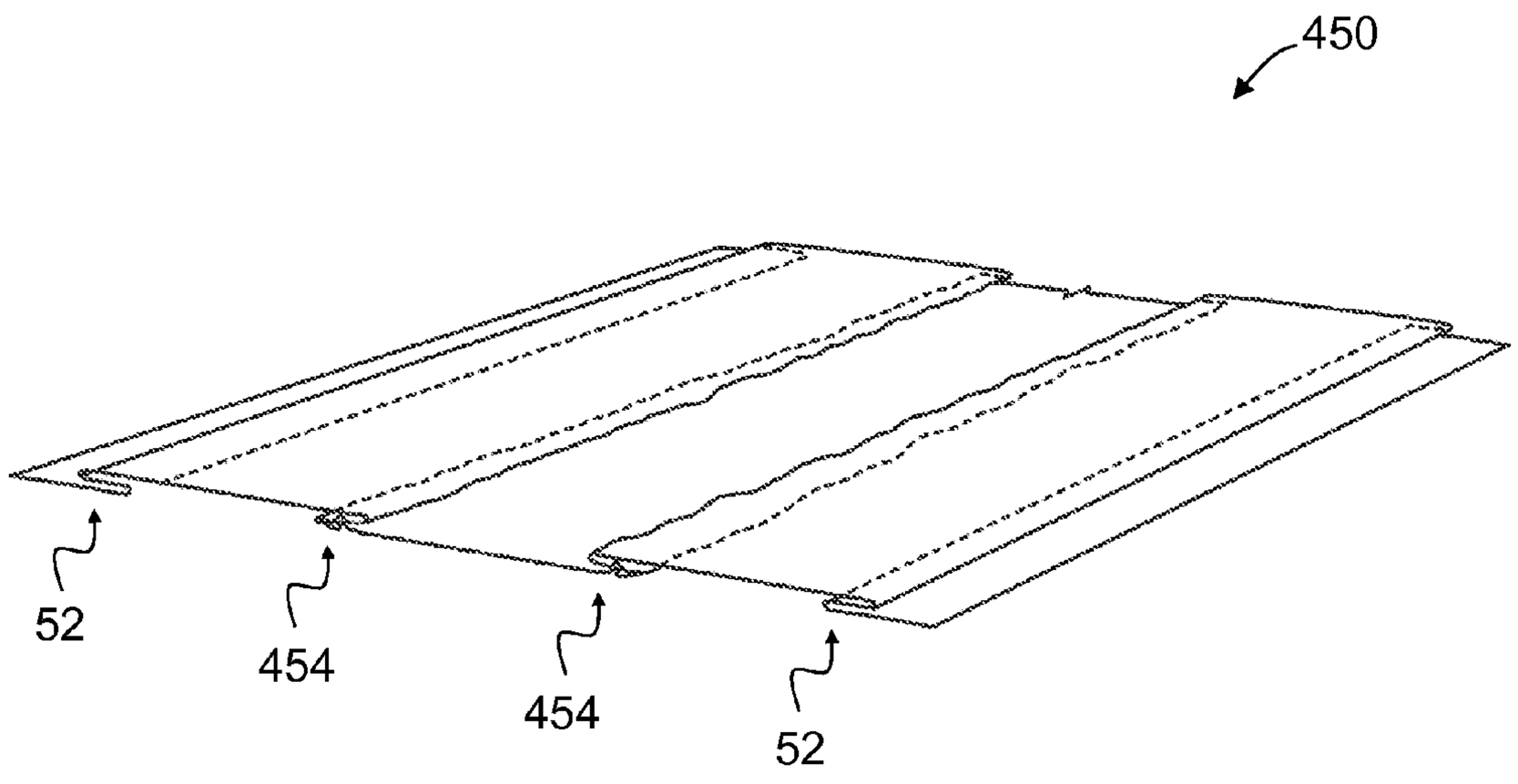


Figure 15

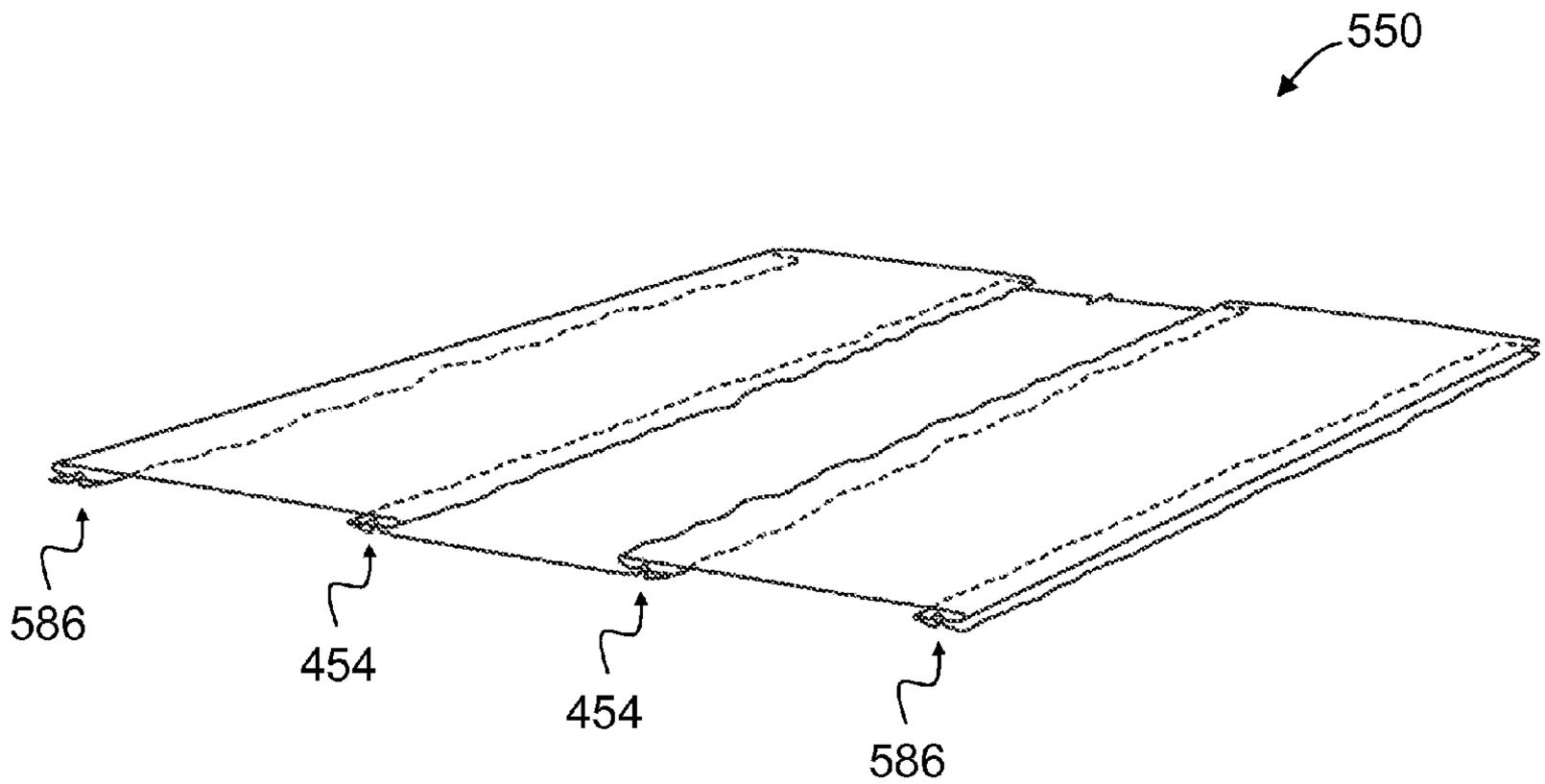


Figure 16

METHOD AND APPARATUS FOR FABRICATING STRETCH FILM ROLLS

FIELD OF THE INVENTION

The present invention relates generally to stretch film and in particular, to a method and apparatus for fabricating stretch film rolls.

BACKGROUND OF THE INVENTION

Stretch film is widely used for wrapping and securing palletized loads for shipping. This is partly due to the fact that stretch film exhibits a "memory", or a tendency to shrink, upon stretching. For example, stretch film that is stretched by an amount of 10% will shrink nearly 10% of its stretched length. This "memory" assists in securing wrapped palletized articles together under compression.

Stretch film is fabricated in the form of stretch film rolls. Each stretch film roll may be used to manually wrap a palletized load, or may be loaded into an automated wrapping machine.

In some situations, the tensile strength of conventional stretch film may be insufficient to withstand tensile forces applied during wrapping, which can cause the stretch film to tear during wrapping.

Improvements are generally desired. It is therefore an object at least to provide a novel method and apparatus for fabricating stretch film rolls.

SUMMARY OF THE INVENTION

In one aspect, there is provided an apparatus for fabricating a stretch film roll, comprising: a device configured to fold a stretch film web to yield a folded stretch film web comprising at least one longitudinal band of increased thickness, each band of increased thickness being spaced from the longitudinal edges of the folded stretch film web; and a driven winding shaft for winding the folded stretch film web.

Each band of increased thickness may comprise a plurality of longitudinal folds. The at least one band of increased thickness may comprise a longitudinal band of wrinkled or bunched stretch film web. The at least one band of increased thickness may comprise a longitudinal pleat. The pleat may comprise at least two longitudinal folds.

The device may comprise: a member having at least one folding edge, and at least one guide, each guide configured to cooperate with a respective folding edge to form a respective longitudinal band of increased thickness. Each guide may be a generally conically-shaped tip. Each guide may be generally disc-shaped. Each generally disc-shaped guide may be configured to be rotatable. The member may be: a form defining at least one longitudinal channel, or at least one guide member. Each guide member may comprise a generally disc-shaped guide. Each generally disc-shaped guide may be configured to be rotatable.

The apparatus may further comprise at least one component configured to be oscillated for oscillating the folded stretch film web. The at least one component configured to be oscillated may be one or more of: at least one roller, at least one additional guide, the device, and the winding shaft. The at least one component may be configured to be oscillated along an axis that is generally orthogonal to a direction of travel of the folded stretch film web. The at least one component may be configured to be oscillated over either a fixed distance or a variable distance. The at least one component may be configured to be oscillated at either a fixed frequency or a variable frequency.

The winding shaft may support a core onto which the folded stretch film is wound. The winding shaft may be a coreless winding shaft onto which the folded stretch film is wound.

The stretch film web may be fabricated by the apparatus. The stretch film web may be provided to the apparatus as a supply of previously-fabricated stretch film web.

In another aspect, there is provided a method for fabricating a stretch film roll, comprising: providing a stretch film web; folding the stretch film web using a device to yield a folded stretch film web comprising at least one longitudinal band of increased thickness, each band of increased thickness being spaced from the longitudinal edges of the folded stretch film web; and winding the folded stretch film web.

The folding may comprise applying the stretch film web against at least one folding edge to form said at least one longitudinal band of increased thickness. The at least one longitudinal band of increased thickness may comprise a band of wrinkled or bunched stretch film web. The at least one longitudinal band of increased thickness may comprise a longitudinal pleat. Each pleat may comprise at least two longitudinal folds.

The method may further comprise oscillating the folded stretch film web prior to said winding. The oscillating may comprise oscillating one or more of the following along an axis that is generally orthogonal to a direction of travel of the folded stretch film web: at least one roller, at least one additional guide, the device, and the winding shaft.

The providing may comprise fabricating the stretch film web. The providing may comprise providing a supply of previously-fabricated stretch film web.

In another aspect, there is provided a method, comprising: providing a stretch film web; passing the stretch film web between a member and at least one guide, the member comprising at least one channel, the at least one guide cooperating with the at least one channel to yield a folded stretch film web comprising at least one longitudinal band of increased thickness.

The at least one guide may cooperate with the at least one channel to wrinkle or bunch the stretch film web. The at least one guide may cooperate with the at least one channel to form a pleat.

The providing may comprise fabricating the stretch film web. The providing may comprise providing a supply of previously-fabricated stretch film web.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments will now be described more fully with reference to the accompanying drawings in which:

FIG. **1** is a side view of a portion of an apparatus for fabricating stretch film rolls, during use;

FIG. **2** is a perspective view of a folding device forming part of the apparatus of FIG. **1**;

FIG. **3** is a sectional front view of the folding device of FIG. **2**;

FIG. **4** is a sectional perspective view of the folding device of FIG. **2**, during use;

FIG. **5** is a sectional view of a portion of a folded stretch film web formed using the apparatus of FIG. **1**;

FIG. **6** is a sectional front view of another embodiment of a folding device forming part of the apparatus of FIG. **1**;

FIG. **7** is a sectional perspective view of the folding device of FIG. **6**, during use;

FIG. **8** is a sectional view of a portion of a folded stretch film web formed using the apparatus of FIG. **6**;

FIG. **9** is a perspective view of another embodiment of a folding device forming part of the apparatus of FIG. **1**;

FIG. **10** is a sectional perspective view of the folding device of FIG. **9**, during use;

FIG. **11** is a sectional front view of the folding device of FIG. **9**, during use;

FIG. **12** is a perspective view of another embodiment of a folding device forming part of the apparatus of FIG. **1**;

FIG. **13** is a perspective view of the folding device of FIG. **12**, during use;

FIG. **14** is a sectional front view of the folding device of FIG. **12**, during use;

FIG. **15** is a sectional view of a portion of another embodiment of a folded stretch film web formed using the apparatus of FIG. **6**; and

FIG. **16** is a sectional view of a portion of still another embodiment of a folded stretch film web.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Turning now to FIG. **1**, a portion of an apparatus for fabricating stretch film rolls is shown, and is generally indicated by reference numeral **20**. Apparatus **20** comprises an extruder (not shown) that is configured to dispense a continuous sheet of plastic film onto a surface of a rotating cast roller (not shown) so as to form a stretch film web **22**. Apparatus **20** also comprises a set of preliminary rollers (not shown) configured to receive the stretch film web **22** from the cast roller.

Apparatus **20** further comprises a folding device **30** that is positioned downstream from the set of preliminary rollers, and that is configured to receive the stretch film web **22** from the set of preliminary rollers. The folding device **30** may be better seen in FIGS. **2** to **4**. Folding device **30** comprises a form **32**, which has a web-facing surface **34** over which the moving stretch film web **22** travels. In this embodiment, the form **32** also has two (2) channels **36**, each of which extends along a longitudinal side of the form **32** in the direction of travel of the stretch film web **22**. Each channel **36** is shaped so as to define a longitudinal folding edge **38** extending along a longitudinal edge of the planar surface **34**.

The folding device **30** also comprises two (2) guides **46** positioned at the sides of the form **32**. Each guide **46** is terminated by a rounded, generally conical tip that is sized to engage a respective channel **36**, and each guide **46** is coupled to an adjustable positioning apparatus (not shown) for enabling the position of the guide **46** relative to the channel **36** to be adjusted as necessary. Each guide **46** is configured to cooperate with its respective folding edge **38** to form a pleat within the stretch film web. Specifically, each guide **46** is configured to direct a portion of the moving stretch film web **22** into the channel **36** and against the folding edge **38**, which in turn causes a portion of the moving stretch film web **22** to fold onto itself downstream from the guide **46** and form a pleat. In this embodiment, the folding device **30** is configured to form a folded stretch film web **50** comprising two (2) pleats **52**, with each pleat **52** comprising two (2) folds separated by a width of about 0.3 inches, as may be seen in FIG. **5**. The folding device **30** is also configured such that each pleat **52** is spaced from the nearest longitudinal edge of the folded stretch film web **50** by at least a distance corresponding to the width of the pleat.

The apparatus **20** further comprises a first intermediate roller **62** that is configured to receive the folded stretch film web **50** from the folding device **30**, and a second intermediate roller **64** that is configured to receive the folded stretch film web **50** from the first intermediate roller **62**. In this embodiment, the first intermediate roller **62** and the second intermediate roller **64** are configured as idler rollers.

Additionally, in this embodiment, the second intermediate roller **64** is configured to be oscillated along an oscillation axis that is generally orthogonal to the direction of travel of the folded stretch film web **50**, so as to cause the moving folded stretch film web **50** to also be oscillated. At least one assembly (not shown) is provided for oscillating the second intermediate roller **64** along the oscillation axis. The second intermediate roller **64** is oscillated at a fixed frequency and over a fixed distance along the oscillation axis. In this embodiment, the fixed frequency is a frequency in the range from about 0.1 cycles per minute to about 200 cycles per minute, and the fixed distance, and namely the distance travelled during one cycle, is a distance in the range from about 0.1 inches to about 4 inches.

Apparatus **20** further comprises a roller **66** that is configured to receive the oscillated, folded stretch film web **50** from the second intermediate roller **64**. Apparatus **20** further comprises a winding shaft **68** positioned adjacent the roller **66** and supporting a core **72**. The winding shaft **68**, with the core **72** supported thereon, is configured to receive the oscillated folded stretch film web **50** from the roller **66** for winding the oscillated folded stretch film web **50** onto the core **72**, so as to form a stretch film roll, and namely a roll of folded stretch film. An assembly (not shown) is provided for rotatably driving the winding shaft **68**. The surface of the folded stretch film wound onto the core **72** is generally in contact with the surface of the roller **66**, so as to prevent air entrapment between layers of the folded stretch film during winding. In this embodiment, the roller **66** is configured as an idler roller.

In use, the extruder dispenses a continuous sheet of plastic film onto the surface of the rotating cast roller to form the stretch film web **22**, which is then received by the set of preliminary rollers. From the set of preliminary rollers, the stretch film web **22** travels downstream and is received by the folding device **30**. As the stretch film web **22** travels through the folding device **30**, it passes over the planar surface **34** of the form **32** and is directed into the channels **36** by the guides **38**, so as to yield a folded stretch film web **50** comprising pleats **52**.

Downstream from the folding device **30**, the folded stretch film web **50** is received by the first intermediate roller **62**, and in turn by the second intermediate roller **64**. The second intermediate roller **64** is oscillated along the oscillation axis, which in turn causes the folded stretch film web **50** to be oscillated. From the second intermediate roller **64**, the oscillated, folded stretch film web **50** is received by the roller **66**, and in turn by the winding shaft **68** supporting the core **72**, at which the oscillated, folded stretch film web **50** is wound onto the core **72** so as to form the roll of folded stretch film.

As will be appreciated, each pleat effectively triples the thickness of the stretch film, and thereby provides a band of reinforcement extending the length of the folded stretch film. As a result, the pleats advantageously increase the tensile strength of the folded stretch film and render the folded stretch film less prone to tearing during use, such as for example during wrapping of palletized loads for shipping, as compared to conventional stretch film.

Additionally, and as will be appreciated, the spacing of each pleat from the longitudinal edge of the folded stretch

film advantageously allows the reinforcement provided by the pleats to be distributed across a greater portion of the width of the film.

Further, and as will appreciated, oscillation of the folded stretch film web prevents direct overlap of the pleats during winding, and thereby allows the shape of the roll of folded stretch film to be controlled. As will be understood, as a result of the oscillation, the roll of folded stretch film has a generally smooth contour, and without large bulges that would otherwise form due to direct overlap of the pleats in absence of oscillation. Additionally, prevention of direct overlap of the pleats during winding advantageously reduces or eliminates additional tension within the film caused by overlapping pleats, which would otherwise cause problems during unwinding of the film.

Other configurations of the folding device are possible. For example, FIGS. **6** and **7** show another embodiment of a folding device, which is generally indicated by reference numeral **130**. Folding device **130** is generally similar to folding device **30** described above and with reference to FIGS. **2** to **4**, and comprises a form **132**. The form **132** has a plurality of web-facing surfaces **134** over which the moving stretch film web **22** travels. In this embodiment, the form **132** also has four (4) channels, namely two (2) outer channels **136** and two (2) inner channels **142**. Each outer channel **136** extends along a longitudinal side of the form **132** in the direction of travel of the stretch film web **22**. Each outer channel **136** is shaped so as to define a longitudinal folding edge **138** extending along the longitudinal edge of a planar surface **134**. Each inner channel **142** extends intermediate the longitudinal sides of the form **132** and in the direction of travel of the stretch film web **22**. Each inner channel **142** is shaped so as to define a longitudinal folding edge **144** extending along a longitudinal edge of a planar surface **134**.

The folding device **30** also comprises four (4) guides, namely two (2) outer guides **146** positioned at the sides of the form **132** and two (2) inner guides **148** positioned intermediate the sides of the form **132**. Each guide **146** and **148** is terminated by a rounded, generally conical tip that is sized to engage a respective channel, and is coupled to an adjustable positioning apparatus (not shown) for enabling the position of the guide relative to the channel to be adjusted as necessary. Each outer guide **146** is configured to cooperate with its respective folding edge **138** to form a pleat within the stretch film web. Specifically, each outer guide **146** is configured to direct a portion of the moving stretch film web **22** into the outer channel **136** and against the folding edge **138**, which in turn causes a portion of the moving stretch film web **22** to fold onto itself downstream from the guide **146** and form a pleat. Similarly, each inner guide **148** is configured to cooperate with a respective folding edge **144** to form a pleat within the stretch film web. Specifically, each inner guide **148** is configured to direct a portion of the moving stretch film web **22** into the inner channel **142** and against the folding edge **144**, so as to cause a portion of the moving stretch film web **22** to fold onto itself downstream from the guide **148** and form a pleat. In this embodiment, the folding device **130** is configured to form a folded stretch film web **150** comprising four (4) pleats **52**, with each pleat **52** comprising two (2) folds separated by a width of about 0.3 inches, as may be seen in FIG. **8**. The folding device **130** is also configured such that each pleat **52** is spaced from the nearest longitudinal edge of the folded stretch film web **150** by at least a distance corresponding to the width of the pleat.

FIGS. **9** to **11** show another embodiment of a folding device, which is generally indicated by reference numeral **230**. Folding device **230** is generally similar to folding device **30** described above and with reference to FIGS. **2** to **4**, and comprises a form **232** that has a web-facing surface **234** over which the moving stretch film web **22** travels. In this embodiment, the form **232** also has two inclined, longitudinal side surfaces **236** extending the length of the form **232** in the direction of travel of the stretch film web **22**. Each longitudinal side surface **236** defines a longitudinal folding edge **238** extending along the longitudinal edge of the planar surface **234**.

The folding device **230** also comprises two (2) guide members **262**, with each guide member **262** positioned adjacent a longitudinal side surface **236** of the form **232**. Each guide member **262** comprises a generally disc-shaped guide **266** mounted to an axle **268**, and is coupled to an adjustable positioning apparatus (not shown) for enabling the position of the guide **266** relative to the form **232** to be adjusted as necessary. In this embodiment, each guide member **262** is configured to rotate freely about its axle **268**, such that each guide **266** is rotatable.

Each guide **266** is configured to cooperate with its respective folding edge **238** to form a pleat within the stretch film web **22**. Specifically, each guide **266** is configured to direct a portion of the moving stretch film web **22** toward the longitudinal side surface **236** and against the folding edge **238**, so as to cause a portion of the moving stretch film web **22** to fold onto itself downstream from the guide **266** and form a pleat. In this embodiment, the folding device **230** is configured to form the folded stretch film web **50** comprising two (2) pleats **52**, with each pleat **52** comprising two (2) folds separated by a width of about 0.3 inches, as described above and with reference to FIG. **5**. The folding device **230** is also configured such that each pleat **52** is spaced from the nearest longitudinal edge of the folded stretch film web **50** by at least a distance corresponding to the width of the pleat.

In other embodiments, one or more of the guide members may alternatively be fixed, and not be configured to rotate freely. In one such embodiment, the guide(s) of the fixed guide member(s) may alternatively have a shape other than generally disc-shaped. For example, in one such embodiment, the guide(s) of the fixed guide member(s) may alternatively be shaped as half-disc(s). It will be understood by those of skill in the art that other guide shapes may alternatively be used.

FIGS. **12** to **14** show another embodiment of a folding device, which is generally indicated by reference numeral **330**. Folding device **330** comprises a plurality of guide members arranged in a spaced relationship. Specifically, the folding device **330** comprises a pair of first guide members **362** and a pair of second guide members **364**. Each first guide member **362** comprises a generally disc-shaped guide **366** mounted to an axle **368**. Each second guide member **364** is similar to the first guide member **362**, and comprises a generally disc-shaped guide **376** mounted to an axle **378**. Each first guide member **362** is coupled to an adjustable positioning apparatus (not shown) for enabling the position of the guide **366** relative to the guide **376** of the second guide member **364** to be adjusted as necessary. In this embodiment, each guide member **362** and **364** is configured to rotate freely about its axle **368** and **378**, respectively, such that each guide **366** and **376** is rotatable.

Each first guide member **362** is configured to cooperate with a respective second guide member **364** to form a pleat within the stretch film web **22**. Specifically, each guide **366** is configured to direct a portion of the moving stretch film

web **22** against a folding edge defined by the proximal edge **382** of each guide **376**, so as to cause a portion of the moving stretch film web **22** to fold onto itself downstream of the guides **366** and **376** (not shown) and form a pleat. In this embodiment, the folding device **330** is configured to form the folded stretch film web **50** comprising two (2) pleats **52**, with each pleat **52** comprising two (2) folds separated by a width of about 0.3 inches, as described above and with reference to FIG. **5**. The folding device **230** is also configured such that each pleat **52** is spaced from the nearest longitudinal edge of the folded stretch film web **50** by at least a distance corresponding to the width of the pleat.

In other embodiments, one or more of the first guide members and the second guide members may alternatively be fixed, and not be configured to rotate freely. In such embodiments, the guide(s) of the fixed guide member(s) may alternatively have a shape other than generally disc-shaped. For example, in one such embodiment, the guide(s) of the fixed guide member(s) may alternatively be shaped as half-disc(s). It will be understood by those of skill in the art that other guide shapes may alternatively be used.

Although in the embodiments described above, the folding device is configured to form a folded stretch film web comprising either two (2) or four (4) pleats, in other embodiments, the folding device may alternatively be configured to form a folded stretch film web comprising a different number of pleats, such as one (1) pleat, three (3) pleats, or more than four (4) pleats. It will be understood that in such alternative embodiments, the folding device would be suitably configured and have a suitable number of guide(s) to form the corresponding number of pleat(s).

Although in the embodiments described above, each pleat comprises two (2) folds separated by a width of about 0.3 inches, in other embodiments, one or more pleats may alternatively comprise two (2) folds separated by a width in the range from about 0.0625 inches to about 4 inches. Still greater widths may be used.

Although in embodiments described above, each pleat is spaced from the nearest longitudinal edge of the folded stretch film web by at least a distance corresponding to the width of the pleat, in other embodiments, each pleat may alternatively be spaced from the nearest longitudinal edge of the folded stretch film web by a distance of about 0.0625 inches or more.

The folding devices of the embodiments described above may alternatively be used to yield stretch film rolls comprising one or more longitudinal bands of wrinkled or bunched film. For example, during use of the folding device **130** described above and with reference to FIGS. **6** and **7**, different operating conditions may result in the formation of one or more bands of wrinkled or bunched film instead of pleats.

For example, in one embodiment, under different operating conditions, each inner guide **148** of the folding device **130** may be configured to direct a portion of the moving stretch film web **22** into the inner channel **142**, so as to cause a portion of the moving stretch film web **22** to wrinkle or bunch downstream from the guide **148** to form a longitudinal band of wrinkled or bunched stretch film web. In this embodiment, the folding device **130** is configured to form a folded stretch film web **450** comprising two (2) pleats **52**, with each pleat **52** comprising two (2) folds separated by a width of about 0.3 inches, and two (2) longitudinal bands **454** of wrinkled or bunched stretch film web, as may be seen in FIG. **15**. Each longitudinal band **454** comprises a wrinkled or bunched portion of stretch film web that has increased thickness and that comprises a plurality of longitudinal folds. Each longitudinal band **454** is spaced from the nearest longitudinal edge of the folded stretch film web **450** by at least a distance corresponding to the width of the longitudinal band. In this embodiment, each longitudinal band **454** has a width of about 0.3 inches.

The folded stretch film web **450** then travels through the apparatus **20** downstream from the folding device **130**, in generally the same manner as described above for folded stretch film web **50**. For example, the second intermediate roller **64**, which is configured to be oscillated along the oscillation axis that is generally orthogonal to the direction of travel of the folded stretch film web **450**, causes the moving folded stretch film web **450** to also be oscillated. Also, the winding shaft **68**, with the core **72** supported thereon, is configured to receive the oscillated folded stretch film web **450** from the roller **66** for winding the oscillated folded stretch film web **450** onto the core **72**, so as to form a stretch film roll, and namely a roll of folded stretch film.

As will be appreciated, each longitudinal band of wrinkled or bunched stretch film increases the thickness of the stretch film, and thereby provides a band of reinforcement extending the length of the folded stretch film. As a result, the longitudinal band(s) of wrinkled or bunched stretch film advantageously increase(s) the tensile strength of the stretch film and render(s) the folded stretch film less prone to tearing during use, such as for example during wrapping of palletized loads for shipping, as compared to conventional stretch film.

Additionally, and as will be appreciated, the spacing of each longitudinal band of wrinkled or bunched stretch film from the longitudinal edge of the folded stretch film advantageously allows the reinforcement to be distributed across a greater portion of the width of the film.

Although in the embodiment described above, each longitudinal band of wrinkled or bunched stretch film web has a width of about 0.3 inches, in other embodiments, at least one longitudinal band may alternatively have a width in the range from about 0.0625 inches to about 4 inches. Still greater widths may be used.

Although in embodiments described above, each longitudinal band of wrinkled or bunched stretch film web is spaced from the nearest longitudinal edge of the folded stretch film web by at least a distance corresponding to the width of the longitudinal band, in other embodiments, at least one longitudinal band may alternatively be spaced from the nearest longitudinal edge of the folded stretch film web by a distance of about 0.0625 inches or more.

It will be appreciated that, in other embodiments, and during use of any of the folding devices described above, different operating conditions may result in the formation of one or more bands of wrinkled or bunched film instead of one or more pleats.

The apparatus may have other configurations. For example, although in the embodiment described above, the second intermediate roller is configured to be oscillated along an oscillation axis, in other embodiments, one or more of the following may alternatively be configured to each be oscillated along a respective oscillation axis: the folding device; the first intermediate roller; the second intermediate roller; the roller adjacent the winding shaft; and the winding shaft. For example, in one such alternative embodiment, the winding shaft may be configured to be oscillated along an oscillation axis, while the other rollers and components of the apparatus may be configured to not be oscillated. In still other embodiments, the apparatus may alternatively comprise one or more additional guides separate from the

folding device that are configured to be oscillated along a respective oscillation axis for oscillating the folded stretch film web.

Although in the embodiment described above, the second intermediate roller is oscillated over a fixed distance along the oscillation axis, in other embodiments, the second intermediate roller may alternatively be oscillated over a variable distance along the oscillation axis, such as for example, a periodically variable distance or a random distance.

Although in the embodiment described above, the second intermediate roller is oscillated over a fixed distance along the oscillation axis, in other embodiments, the second intermediate roller may alternatively be oscillated over a variable distance along the oscillation axis, such as for example, a periodically variable distance or a random distance.

Although in the embodiment described above, the fixed frequency is a frequency in the range from about 0.1 cycles per minute to about 200 cycles per minute, in other embodiments, the fixed frequency may alternatively be a frequency that is greater than 200 cycles per minute.

Although in the embodiment described above, the fixed distance is a distance in the range from about 0.1 inches to about 4 inches, in other embodiments, the fixed frequency may alternatively be a distance that is greater than 4 inches.

Although in the embodiment described above, the oscillation axis of the second intermediate roller is generally orthogonal to the direction of travel of the folded stretch film web, in other embodiments, the oscillation axis of the cutting station and the cutting blades may alternatively be non-orthogonal to the direction of travel of the folded stretch film web.

Although in the embodiment described above, the first intermediate roller and the second intermediate roller are configured as idler rollers, in other embodiments, one or both of the first intermediate roller and the second intermediate roller may alternatively be configured as a driven roller.

Although in the embodiment described above, the apparatus comprises a first intermediate roller and a second intermediate roller, in other embodiments, the apparatus may alternatively comprise fewer or more intermediate rollers. In one embodiment, the apparatus may alternatively comprise no intermediate rollers.

Although in the embodiment described above, the apparatus comprises a winding shaft supporting a core, in other embodiments, the apparatus may alternatively comprise a coreless winding shaft that does not support a core, onto which the oscillated folded stretch film web is wound so as form a coreless roll of folded stretch film.

Although in the embodiment described above, the roller adjacent the winding shaft is configured as an idler roller, in other embodiments, the roller adjacent the winding shaft may alternatively be configured as a driven roller. In one such embodiment, the surface speed of the driven roller may be matched to the surface speed of the wound film on the winding shaft using automated or computer-controlled speed matching. In another such embodiment, there may be no assembly provided for rotatably driving the winding shaft, and the winding shaft may alternatively be driven through contact with the surface of the driven roller.

Those skilled in the art will appreciate that the apparatus is not limited to the components described above. For example, in other embodiments, one or more of the first intermediate roller, the second intermediate roller, and the roller adjacent the winding shaft, may alternatively not be provided.

Other apparatus configurations are possible. For example, although in the embodiment described above, the apparatus comprises an extruder and a rotating cast roller for forming the stretch film web, in other embodiments, the apparatus may alternatively not comprise an extruder and a cast roller for forming the stretch film web, but may alternatively comprise a supply (e.g. a spool, a roll, etc.) of previously-fabricated stretch film web, and provisions for feeding the stretch film web from the supply either directly or indirectly to the folding device. It will be understood that such a configuration would provide an "off-line" or "secondary" apparatus for fabricating the stretch film roll, and namely the roll of folded stretch film. Those skilled in the art will recognize that such previously-fabricated stretch film webs may otherwise typically be used for other "off-line" or "secondary" processes such as, for example, one or more of: conventional rewinding, slitting, pre-stretching, and edge folding/rolling.

For example, FIG. **16** shows another embodiment of a folded stretch film web formed using another embodiment of an apparatus (not shown), and which is generally indicated by reference numeral **550**. Folded stretch film web **550** is formed using a secondary apparatus (not shown) for fabricating a stretch film roll. In this embodiment, the secondary apparatus comprises a supply (e.g. a spool, a roll, etc.) of previously-fabricated stretch film web, and provisions (not shown) for feeding the stretch film web from the supply (not shown) to the downstream portion of the secondary apparatus. The secondary apparatus also comprises an edge rolling device (not shown) configured to roll the edges of the stretch film web, so as to form edge rolls **586**. Each edge roll **586** comprises a rolled, generally wrinkled or bunched portion of stretch film web extending the length of an edge of the stretch film web. Edge rolling devices configured to form edge rolls have been previously described, for example, in U.S. Pat. No. 5,531,393 to Salzsauler et al.

The secondary apparatus further comprises a folding device (not shown) positioned downstream from the edge rolling device. The folding device is similar to folding device **130** described above and with reference to FIGS. **5** to **7**, but comprises a form (not shown) having only two (2) inner channels (not shown). The folding device of this embodiment also comprises two (2) inner guides (not shown), each sized to engage a respective channel. In this embodiment, the folding device is configured to form a folded stretch film web **550** comprising two (2) longitudinal bands **454** of wrinkled or bunched stretch film web, in a similar manner as longitudinal bands **454** described above and with reference to FIG. **15**. Each longitudinal band **454** comprises a wrinkled or bunched portion of stretch film web that has increased thickness and that comprises a plurality of longitudinal folds. Each longitudinal band **454** is spaced from the nearest longitudinal edge of the folded stretch film web. Further, each longitudinal band **454** is spaced from the nearest edge roll **586** of the folded stretch film web **450** by at least a distance corresponding to the width of the longitudinal band. In this embodiment, each longitudinal band **454** has a width of about 0.3 inches.

In this embodiment, the secondary apparatus further comprises one or more oscillating members (not shown) configured to yield an oscillated, folded stretch film web **550**, and a winding shaft (not shown) for winding the oscillated folded stretch film web **550** to form a stretch film roll, and namely a roll of folded stretch film comprising two (2) longitudinal bands **454** of wrinkled or bunched stretch film web and two (2) edge rolls **586**, as shown in FIG. **16**.

Although in the embodiment described above, the edge rolling device is positioned upstream from the folding device, in other embodiments, the edge rolling device may alternatively be positioned downstream from the folding device.

Although in the embodiment described above, the secondary apparatus also comprises an edge rolling device configured to roll the edges of the stretch film web, in other embodiments, the secondary apparatus may alternatively comprise an edge folding device configured to fold the edges of the stretch film web.

Although in the embodiment described above, each longitudinal band of wrinkled or bunched stretch film web has a width of about 0.3 inches, in other embodiments, at least one longitudinal band may alternatively have a width in the range from about 0.0625 inches to about 4 inches. Still greater widths may be used.

Although in embodiments described above, each longitudinal band of wrinkled or bunched stretch film web is spaced from the nearest edge roll of the folded stretch film web by at least a distance corresponding to the width of the longitudinal band, in other embodiments, at least one longitudinal band may alternatively be spaced from the nearest edge roll of the folded stretch film web by a distance of about 0.0625 inches or more.

In other embodiments, different operating conditions may result in the formation of one or more pleats instead of one or more of longitudinal bands of wrinkled or bunched stretch film web.

It will be appreciated that the stretch film roll, and namely the roll of folded stretch film in accordance with the above-described embodiments, may therefore comprise: one or more pleats and/or one or more longitudinal bands of wrinkled or bunched stretch film web, in any combination, and may optionally comprise edge rolls or edge folds, and may be fabricated using an "offline" or "secondary" apparatus, or using a "non-offline" or "non-secondary" apparatus.

Although embodiments have been described above with reference to the accompanying drawings, those of skill in the art will appreciate that variations and modifications may be made without departing from the scope thereof as defined by the appended claims.

What is claimed is:

1. An apparatus for fabricating a stretch film roll, comprising:

a device configured to fold a stretch film web to yield a folded stretch film web comprising at least one longitudinal band of increased thickness, each band of increased thickness being spaced from the longitudinal edges of the folded stretch film web;

at least one component configured to be oscillated for oscillating the folded stretch film web; and

a driven winding shaft for winding the folded stretch film web into a roll,

wherein the at least one component configured to be oscillated is one or more of: at least one roller, at least one additional guide, the device, and the winding shaft.

2. The apparatus of claim **1**, wherein each band of increased thickness comprises a plurality of longitudinal folds.

3. The apparatus of claim **1**, wherein the at least one band of increased thickness comprises a longitudinal band of wrinkled or bunched stretch film web.

4. The apparatus of claim **1**, wherein the at least one band of increased thickness comprises a longitudinal pleat.

5. The apparatus of claim **4**, wherein the pleat comprises at least two longitudinal folds.

6. The apparatus of claim **1**, wherein the device comprises:

a member having at least one folding edge, and

at least one guide, each guide configured to cooperate with a respective folding edge to form a respective longitudinal band of increased thickness.

7. The apparatus of claim **6**, wherein each guide is a generally conically-shaped tip.

8. The apparatus of claim **6**, wherein each guide is generally disc-shaped.

9. The apparatus of claim **8**, wherein each generally disc-shaped guide is configured to be rotatable.

10. The apparatus of claim **6**, wherein the member is:

a form defining at least one longitudinal channel, or

at least one guide member.

11. The apparatus of claim **1**, wherein the at least one component is configured to be oscillated along an axis that is generally orthogonal to a direction of travel of the folded stretch film web.

12. The apparatus of claim **1**, wherein the winding shaft supports a core onto which the folded stretch film is wound.

13. The apparatus of claim **1**, wherein the winding shaft is a coreless winding shaft onto which the folded stretch film is wound.

14. The apparatus of claim **1**, wherein the stretch film web is fabricated by the apparatus.

15. The apparatus of claim **1**, wherein stretch film web is provided to the apparatus as a supply of previously-fabricated stretch film web.

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